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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is also included. (AG)

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FOR

GAS SERVICEMAN (light, heat & power) 5-83.947

B-48lor S-208

U. S. Employment Service in
Cooperation with
Minnesota State Employment Service

September 1962

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STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

GAS SERVICEMAN 5-83.947

B-481 or S-208

Summary

The GATB, B-1002B, was administered to a total sample of 51 men employed as Gas Serviceman 5-83.947 by Northern States Power Company located in St. Paul, Minnesota. The criterion consisted of supervisory pair-comparison rank order ratings. On the basis of mean scores, standard deviations, correlations with criterion, job analysis data, and their combined selective efficiency, Aptitudes G--Intelligence, N--Numerical, and P-Form Perception were selected for inclusion in the test norms.

GATB Norms for Gas Serviceman 5-83.947 B-481 or S-208

Table I shows, for B-1001 and B-1002, the minimum acceptable score for each aptitude included in the test norms for Gas Serviceman, 5-83.947.

TABLE I

Minimum Acceptable Scores on B-1001 and B-1002 for B-481 or S-208

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
G	CB-1-H CB-1-J CB-1-I	95	G	Part 3 Part 4 Part 6	90
N	CB-1-D CB-1-I	85	N	Part 2 Part 6	80
P	CB-1-A CB-1-L	70	P	Part 5 Part 7	70

Effectiveness of Norms

The data in Table V indicate that 14 of the 18 poor workers, or 78 percent of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 78 percent of the poor workers would not have been hired if the recommended test norms had been used in the selection process. Moreover, 24 of the 28 workers who made qualifying test scores, or 86 percent, were good workers.

I. Problem

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupation of Gas Serviceman 5-83.947.

II. Sample

The General Aptitude Test Battery, B-1002B, was administered during the period June 10, 1960 to November 30, 1960 to a sample of 78 men employed as GAS SERVICEMAN, 5-83.947; GAS-METER REPAIRMAN, 5-83.461; GAS-GOVERNOR REPAIRMAN (Gas Regulatorman) 5-83.948. The final sample consisted of the 51 Gas Servicemen. The Gas-Meter Repairmen and Gas Regulatormen were not included in the final sample because the job duties were not comparable to those of the Gas Servicemen. The workers in the final sample had all worked as Gas Servicemen for at least 5 years.

Table II shows the means, standard deviations, ranges, and Pearson product-moment correlations with the criterion for age, education, and experience.

TABLE II

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education and Experience

N = 51

	M	σ	Range	r
Age (years)	39.6	9.2	27-63	.085
Education (years)	10.9	1.7	8-13	.009
Experience (months)	15.8	8.8	5-43	.090

There are no significant correlations between age, education, and experience. The data indicate that this sample is suitable for test development purposes with respect to age, education, and experience.

Group of the subjects in the sample, who were over 54 years of age, had test scores comparable to the remainder of the sample. From this observation, and the nonsignificant correlations obtained, it is apparent that these subjects were suitable for inclusion in this sample.

III. Job Description

Job Title: Gas Serviceman, 5-83.947

Job Summary: Tests, repairs, and installs industrial and commercial gas equipment, domestic gas appliances, and gas pressure regulators and meters.

Work Performed: Installs gas pressure regulators and meters. Cuts and installs pipe fittings from shut-off valve to meter, using pipe-fitting tools; connects meter to piping using wrenches; uncaps pipe; lets off air; lights all pilot lights. Checks all gas equipment for proper operation. Overhauls regulators and tests system for gas leaks, using explosive meter and gas meter.

Connects, adjusts and repairs gas appliances. Installs connector between piping and appliances; tightens union with wrench and adjusts pilot light and burners. Converts meter RPM's to cubic feet per hour; checks proper B.T.U. output of appliances. Selects size drill to provide proper orifice so as to supply required amount of gas to burner. Tests oven temperature against pyrometer reading; adjusts temperature controls or replaces over capillary, which controls gas feed value in thermostat. Tests refrigerator temperature, using fluid thermometer, and tests griddles, using heaters by loosening dial from shaft with allen wrench and screw driver and resetting dial according to temperature variation. Advises customer on proper and efficient use of gas.

IV. Experimental Battery

All of the tests of the GATB, B-1002B, were administered to the sample group.

V. Criterion

The criterion data collected for this study consisted of first and second paired-comparison rank order ratings by the Gas Serviceman Supervisor. A correlation coefficient of .982, significant at the .01 level of confidence, was obtained between these two sets of rank order ratings. The final criterion was established by adding the individual's rank on the second rating to his rank on the first rating, after which these totals were arranged in rank order. The ties that occured were then broken by this same supervisor who inspected and approved the final rank order rating. As a final step these rank order ratings were converted to linear scores. The final criterion scores ranged from 6-94 with a mean of 50.0 and standard deviation of 18.7.

VI. Qualitative and Quantitative Analyses

A. Qualitative Analysis:

The job analysis indicated that the following aptitudes measured by the GATB appear to be important for this occupation.

Numerical Aptitude (N) - Needed in computing and understanding functions such as temperature readings, thermostat calibration, conversion of meter RPM's to cubic feet per hour intake of appliances, selection of proper drill size to drill orifice to supply required amount of gas to burner and for computing volume of air necessary to support efficient combustion.

Form Perception (P) - Required for recognizing pertinent detail and making visual comparisons in installation and threading of proper sized pipes and fittings, drilling orifices, and calibration of thermostats.

Finger Dexterity (F) and Manual Dexterity (M) - Needed to handle and manipulate tools and parts in cramped or awkward working positions.

On the basis of the job analysis data, the following aptitude is considered obviously unimportant for performing the duties of this job and is considered an "irrelevant" aptitude: V-Verbal Aptitude.

B. Quantitative Analysis:

Table III shows the means, standard deviations, and Pearson product-moment correlations with the criterion for the aptitudes of the GATB. The means and standard deviations of the aptitudes are comparable to general population norms with a mean of 100 and a standard deviation of 20.

TABLE III

Means (M), Standard Deviations (σ), and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB

N = 51

Aptitudes	M	σ	r
G-Intelligence	94.6	15.4	.516**
V-Verbal Aptitude	96.6	13.1	.446**
N-Numerical Aptitude	89.3	18.5	.460**
S-Spatial Aptitude	100.7	14.8	.255
P-Form Perception	89.1	18.9	.362**
Q-Clerical Perception	95.4	13.1	.233
K-Motor Coordination	97.0	21.2	.268
F-Finger Dexterity	90.3	21.8	.231
M-Manual Dexterity	106.1	21.5	.254

**Significant at the .01 level

Aptitudes V, S, K and M have the highest mean scores and aptitudes V, S and Q have relatively low standard deviations. For a sample of 51 cases, correlations of .358 and .276 are significant at the .01 level and the .05 level of confidence, respectively. Aptitudes G, V, N and P correlate significantly with the criterion at the .01 level. None of the aptitudes correlate significantly with the criterion at the .05 level.

C. Selection of Test Norms

TABLE IV

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important			X		X			X	X
Irrelevant		X							
Relatively High Mean		X		X			X		X
Relatively Low Sigma		X		X		X			
Significant Correlation with Criterion	X	X	X		X				
Aptitudes to be considered for trial norms	G		N	S	P				M

Trial norms consisting of various combinations of Aptitudes G, N, S, P and M with appropriate cutting scores were evaluated against the criterion by means of the tetrachoric correlation technique. A comparison of the results showed that B-1002 norms consisting of G-90, N-80 and P-70 had the best selective efficiency.

VII. Validity of Norms

The validity of the norms was determined by computing a tetrachoric correlation coefficient between the test norms and the criterion and applying the Chi Square test. The criterion was dichotomized by placing 35 percent of the sample in the low criterion group because this percent was considered to be the unsatisfactory or marginal workers.

Table V shows the relationship between test norms consisting of Aptitudes G, N and P with critical scores of 90, 80 and 70 respectively, and the dichotomized criterion for Gas Serviceman, 5-83.947. Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

TABLE V

Validity of Test Norms for Gas Serviceman 5-83.947

(G-90, N-80, P-70)

N= 51

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	9	24	33
Poor Workers	14	4	18
Total	23	28	51

$r_{tet} = .71$ $\quad X^2 = 9.979$

$^{o}r_{tet} = .23$ $\quad P/2 = .005$

The data in the above table indicate a significant relationship between the test norms and the criterion for the sample.

VIII. Conclusions

On the basis of the results of this study, Aptitudes G, N and P with minimum scores of 90, 80 and 70 respectively, have been established as B-1002 norms for the occupation of Gas Serviceman 5-83.947. The equivalent B-1001 norms consist of G-95, N-85 and P-70.

IX. Determination of Occupational Aptitude Pattern

The specific norms established for this study did not meet the requirements for allocation to any of the existing 35 occupational aptitude patterns. The data for this sample will be considered for future groupings of occupations in the development of new occupational aptitude patterns.